

ANNALS OF SURGERY.

THE EMPLOYMENT OF LOCAL ANÆSTHESIA IN
THE RADICAL CURE OF CERTAIN CASES OF
HERNIA, WITH A NOTE UPON THE NERVOUS
ANATOMY OF THE INGUINAL REGION.

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[From the Surgical Clinic of Professor Halsted.]

A BRIEF report was made before the Johns Hopkins Hospital Medical Society in May, 1898, on the propriety of using a local anæsthetic while operating upon certain cases of hernia, when the patient's age and physical condition seemed to prohibit general narcosis.

Since our first cocaine operation, December 6, 1897, to the present time, December 6, 1899, 233 herniotomies have been performed, forty-nine of them under regionary anæsthesia. These latter cases have been operated upon by Professor Halsted, Dr. Bloodgood, and the writer, and, for a variety of reasons, in the majority of them the administration of ether or chloroform seemed inadvisable or positively contraindicated, whereas, in the remainder, the local anæsthetic was employed at the patient's personal request.

Almost all cases of hernia, with the possible exception of those in young children, could undoubtedly be subjected to the radical operation under similar local methods, but when a general anæsthetic can safely be administered, for various reasons it is much to be preferred by both patient and operator. Under

local anæsthesia some pain is necessarily inflicted, and to spare the patient, it is a temptation to slight certain steps of an elaborate plastic operation. Furthermore, the operation necessarily consumes more time, and the responsibility of bolstering up the patient's courage is often most wearing on the surgeon. This, however, is not invariably the case, since personal inhibition towards pain varies so greatly with the individual. As Gottstein says, "*Die Schmerzempfindung bei verschiedenen Menschen verschieden ist,*" and many people readily submit to the slight immediate suffering incidental to operative procedures under local anæsthesia in preference to enduring the discomforts secondary to general narcosis. For those individuals who endure pain with but slight control, it is fortunate that there are certain adjuvants, such as the preliminary administration of morphia and occasional inhalations of chloroform during the operation, which may render the objections to the local method less valid, but, nevertheless, the anæsthesia of choice will continue to be a general and not a local one.¹

In certain conditions, however, complete narcosis is contraindicated, and it is my object to report the results of our observations upon cases which have been operated upon under these circumstances.

Advanced age, chronic bronchitis and emphysema, tuberculosis laryngeal or pulmonary, cardiovascular changes of

¹ Since this paragraph was written observations upon the nervous anatomy of the inguinal region, reviewed in the latter part of this paper, have so greatly assisted us in the performance of a painless operation that the above statements may be qualified to a considerable degree. During the fall of 1899, twenty-four herniotomies with cocaine or eucaine β have been performed in young men practically without pain, and this procedure has become so popularized in the ward where our hernia cases are admitted that the operation under the local anæsthetic has become the operation of choice. An individual awaiting operation needs to remain in the ward only long enough to compare the convalescence of an ether case and that of one done under cocaine to choose the latter method for himself. These patients usually regard the shaving and skin preparation as the most trying part of the operation. Most of the observations on cutaneous anæsthesia have been made on these cases during the operation and immediately after closing the wound. It has been found that the patient can assist not a little in certain steps of the operation, as, for example, when the neck of the sac is closed, in making negative abdominal pressure to prevent the omentum, or bowel, from being pushed down between the peritoneal sutures.

marked degree, chronic nephritis, and, above all, the shock and vomiting in strangulation have been factors in the selection of these cases. One of Dr. Bloodgood's patients was eighty-four years of age, and operative intervention for his large uncontrollable hernia had been refused him several times. In another case the local anæsthetic was chosen because a previous administration of ether for the purpose of operating on a suppurative ethmoiditis had almost resulted in a death on the table. Another case was that of a sickly child with bronchopneumonia and an incarcerated congenital hernia; another, a case with tuberculous laryngitis. Other specific illustrations might be given, but, as will be seen on consulting the appended table, the two conditions which have been chiefly responsible for the avoidance of inhalation methods of anæsthesia have been (1) the combination of arteriosclerosis with cough from chronic bronchitis and emphysema in patients past middle life, and (2) the shock and vomiting associated with strangulation.

During the past eighteen months, in Dr. Halsted's house-service, about 200 cocaine operations have been registered, many of them major operations, and often upon patients to whom, for reasons similar to those reviewed above, it seemed unwise to administer ether or chloroform. About thirty laparotomies have thus been performed under local anæsthesia; several exploratory sections; two gastrostomies by the Ssabanejew-Frank method; closure of a traumatic rupture of the jejunum; three cholecystostomies for empyema of the gall-bladder; three appendectomies, one acute case in a patient with extensive bronchiectasis and osteo-arthritis, a second, an "interval" operation through a McBurney incision in a young man with tuberculous laryngitis, and the third case, the removal of a chronic appendix, with adhesions, which had given abdominal symptoms, supposed to be perforative, in a patient with typhoid fever. On September 7, of this year, the writer, under cocaine anæsthesia, operated and closed one perforation of the ileum in a typhoid case, and inverted two other suspiciously thin Peyer's patches. I succeeded without difficulty in resecting a pylorus for carcinoma in an old woman who had a large cavity in one lung, and again, in doing a gastro-enterostomy, by a

method similar to Roux's, which required a double suture. It is extraordinary that handling, resecting, and suturing the bowel should be unattended by pain. Lilienthal has called attention to this. The same may be said of the omentum. In one herniotomy a large mass, the size of two fists, was excised without pain. Cocainization of the gut has never been necessary. Any attempt to drag upon the bowel, however, does cause pain similar in character to that of peristaltic cramp. This has been observed several times in handling strangulated loops, and in one of the appendectomies referred to, while lifting up the organ to free it from the surrounding adhesions, pain, referred to the epigastrium and resembling the patient's previous attacks of appendicular colic, was occasioned. Amputation of the appendix, however, has always been painless.

A great number of minor operations are, of course, readily performed under local anaesthesia, and it is consequently very largely employed in out-patient clinics. In dealing with the large group of thyroid enlargements and growths in the neck, in which there is any tracheal compression, Kocher has demonstrated cocaine to be almost a *sine qua non* of operation. Local anaesthesia is especially suitable for such operations as the ligation of varicose veins, suprapubic cystostomies, even in patients who might safely take an anaesthetic, and all scrotal operations, as for varicocele, hydrocele, castration, etc., are simply performed through the high incision which is employed at this hospital, provided the ileo-inguinal nerve is previously cocainized in the canal. This will be dwelt upon later.

It is the writer's intention, however, to confine himself chiefly to the hernia group of cases, and accordingly they have been tabulated, with some of the most important data relating thereto.

TABLE OF HERNIOTOMIES PERFORMED UNDER LOCAL ANAESTHESIA BY
COCAINE.

(In this list those cases alone are included in which a general anaesthetic, for the reasons given in the table, seemed contraindicated. The twenty-four cases in which cocaine was simply the anaesthetic of the patient's selection are not included.)

CASE 1.—Surgical No. 7196, December 6, 1897, Cushing. Age, fifty-

three years, male. *Character of hernia*, large left inguinal; strangulated forty-eight hours; viable bowel. *Reason for selection of local anæsthetic*, arteriosclerosis; shock and vomiting of ileus. *Character of operation*, simple relief of strangulation with reduction; closure (radical cure at a later date). *Complications*, none. *Result*, healing *per primam*; well.

CASE II.—Surgical No. 7623, April 21, 1898, Cushing. *Age*, sixty-seven years, male. *Character of hernia*, large right inguinal; recently incarcerated. *Reason for selection of local anæsthetic*, chronic bronchitis an emphysema; arteriosclerosis (extreme); chronic nephritis. *Character of operation*, radical cure; simple closure of abdominal wall after section of spermatic cord. *Complications*, none. *Result*, healing *per primam*; well.

CASE III.—Surgical No. 7652, April 27, 1898, Cushing. *Age*, thirty-nine years, male. *Character of hernia*, large left inguinal; strangulated six hours; bowel viable. *Reason for selection of local anæsthetic*, frequent vomiting of ileus; shock. *Character of operation*, radical cure; section of spermatic cord, as testicle was atrophied. *Complications*, some swelling of testicle. *Result*, healing *per primam*; well.

CASE IV.—Patient of Dr. Gaver, May 1, 1898, Cushing. *Age*, fifty years, female. *Character of hernia*, small right femoral; strangulated three days; bowel viable. *Reason for selection of local anæsthetic*, no assistant. *Character of operation*, radical cure. *Complications*, none. *Result*, healing *per primam*; well.

CASE V.—Surgical No. 7769, June 8, 1898, Bloodgood. *Age*, sixty-seven years, male. *Character of hernia*, small left inguinal. *Reason for selection of local anæsthetic*, age and chronic nephritis. *Character of operation*, radical cure; section of cord; transplantation of rectus muscle. *Complications*, some swelling of testicle; hæmatoma. *Result*, well.

CASE VI.—Surgical No. 7777, June 8, 1898, Bloodgood. *Age*, fifty years, female. *Character of hernia*, small right femoral; strangulated; bowel viable. *Reason for selection of local anæsthetic*, frequent vomiting. *Character of operation*, radical cure. *Complications*, none. *Result*, healing *per primam*; well.

CASE VII.—Surgical No. 7804, June 13, 1898, Bloodgood. *Age*, fifty-two years, female. *Character of hernia*, large umbilical; symptoms of strangulation, four days; bowel viable. *Reason for selection of local anæsthetic*, obesity; frequent vomiting. *Character of operation*, radical cure; wound drained. *Complications*, continuance of vomiting; diarrhoea, etc. *Result*, healing *per primam* and *per sec.*; well.

CASE VIII.—Surgical No. 7861, July 6, 1898, Bloodgood. *Age*, eighty-three years, male. *Character of hernia*, very large right inguinal. *Reason for selection of local anæsthetic*, age; arteriosclerosis; aortic insufficiency. *Character of operation*, radical cure, with rectus transplantation; castration. *Complications*, none; catheterized once. *Result*, healing *per primam*; well.

CASE IX.—Surgical No. 8102, September 11, 1898, Cushing. *Age*, sixty-five years, male (colored). *Character of hernia*, small right inguinal;

strangulated ten hours; bowel viable. *Reason for selection of local anæsthetic*, condition good; might have had general anæsthesia. *Character of operation*, radical cure; Bassini's operation. *Complications*, none. *Result*, healing *per primam*; well.

CASE X.—Surgical No. 8269 (cf. 7861), October 25, 1898, Bloodgood. *Age*, eighty-four years, male. *Character of hernia*, small left inguinal. *Reason for selection of local anæsthetic*, age; arteriosclerosis, etc. *Character of operation*, radical cure; simple closure after excision of sac and section of cord. *Complications*, none. *Result*, healing *per primam*; well.

CASE XI.—Surgical No. 8392, December 2, 1898, Bloodgood. *Age*, sixty-two years, male. *Character of hernia*, large right inguinal. *Reason for selection of local anæsthetic*, shock of ilens; vomiting. *Character of operation*, simple relief of strangulation; suspicious gut left in wound. *Complications and result*, death from pneumonia, following chloroform administration, the following day, given during resection of suspicious bowel.

CASE XII.—Surgical No. 8445, December 28, 1898, Cushing (cf. reported in full). *Age*, seventy-one years, male. *Character of hernia*, large right inguinal. *Reason for selection of local anæsthetic*, chronic bronchitis with emphysema; cardiac hypertrophy; arteriosclerosis; alcoholism. *Character of operation*, radical cure; simple closure after excision of sac and section of cord. *Complications*, pleurisy; cardiac insufficiency temporary; considerable abdominal distention. *Result*, healing *per primam*; well.

CASE XIII.—Surgical No. 8445, January 30, 1899, Cushing. *Age*, seventy-one years, male. *Character of hernia*, large left inguinal. *Reason for selection of local anæsthetic* (given above, Case XII). *Character of operation*, radical cure; simple closure after excision of sac and section of cord; transplantation of rectus. *Complications*, none. *Result*, healing *per primam*; well.

CASE XIV.—Surgical No. 8511, January 12, 1898, Cushing. *Age*, fifty years, male. *Character of hernia*, large direct inguinal. *Reason for selection of local anæsthetic*, chronic bronchitis and emphysema; myocarditis. *Character of operation*, radical cure; Halsted's operation; a few whiffs of chloroform necessary for closure. *Complications*, none; catheterization required twice. *Result*, healing *per primam*; well.

CASE XV.—Surgical No. 8591, February 1, 1899, Professor Halsted. *Age*, seventy-two years, male. *Character of hernia*, small right inguinal. *Reason for selection of local anæsthetic*, arteriosclerosis. *Character of operation*, radical cure; transplantation of rectus. *Complications*, abdominal distention and pain for some days, probably from preliminary morphia. *Result*, healing *per primam*; well.

CASE XVI.—Surgical No. 8619, February 15, 1899, Cushing. *Age*, sixty-eight years, male. *Character of hernia*, large right femoral. *Reason for selection of local anæsthetic*, chronic suppuration of ethmoid cells; had previously nearly succumbed to ether. *Character of operation*, radical cure;

Halsted's method by granulation. *Complications*, none; catheterization necessary during recumbency; hypertrophied prostate. *Result*, healing by granulation; well.

CASE XVII.—Surgical No. 8630, February 6, 1899, Cushing. *Age*, fifty-nine years, female. *Character of hernia*, small left femoral; incarcerated ten days; bowel viable. *Reason for selection of local anæsthetic*, extreme prostration. *Character of operation*, radical cure. *Complications and result*, death on second day; continuance of prostration; subnormal temperature.

CASE XVIII.—Surgical No. 8726, March 7, 1899, Cushing. *Age*, three and one-half months, male. *Character of hernia*, right congenital; strangulated; viable. *Reasons for selection of local anæsthetic*, double broncho-pneumonia. *Character of operation*, radical cure. *Complications and result*, death on second day; broncho-pneumonia antedating operation. *Autopsy*.

CASE XIX.—Surgical No. 9081, June 18, 1899, Cushing. *Age*, sixty-eight years, male. *Character of hernia*, large right inguinal, with hydrocele. *Reason for selection of local anæsthetic*, chronic bronchitis. *Character of operation*, radical cure; simple closure after excision of sac and section of cord; excision of hydrocele. *Complications*, none. *Result*, healing *per primam*; well.

CASE XX.—Surgical No. 8754, March 21, 1899, Cushing. *Age*, seventy-six years, male. *Character of hernia*, small right inguinal; strangulated four days; gangrenous. *Reason for selection of local anæsthetic*, pronounced shock and vomiting; bronchitis; chronic nephritis; arteriosclerosis; stercoraceous vomiting. *Character of operation*, simple relief of constriction; establishment of artificial anus. *Complications and result*, resection of bowel and end-to-end suture, under cocaine, on second day; death from broncho pneumonia sixth day. *Autopsy*, peritoneum sterile; suture intact.

CASE XXI.—Surgical No. 9228, July 28, 1899, Cushing. *Age*, fifty-eight years, male. *Character of hernia*, very large left inguinal. *Reason for selection of local anæsthetic*, chronic bronchitis and emphysema; arteriosclerosis; alcoholism. *Character of operation*, radical cure; simple closure after excision of sac and castration. *Complications*, none. *Result*, healing *per primam*; well.

CASE XXII.—Patient of Dr. Ellis, August 3, 1899, Cushing. *Age*, fifty-five years, female. *Character of hernia*, small right femoral; strangulated three days; gangrenous. *Reason for selection of local anæsthetic*, prostration; vomiting. *Character of operation*, excision of gangrenous area; establishment of artificial anus; subsequently admitted to house for operation. *Complications*, none. *Result*, August 24, 1899, resection of bowel; lateral anastomosis; peritoneal closure without drainage; recovery.

CASE XXIII.—Surgical No. 9274, August 5, 1899, Cushing. *Age*, forty-five years, male. *Character of hernia*, large right inguinal; strangulated three days; viable. *Reason for selection of local anæsthetic*, pronounced shock; hicough and vomiting; arteriosclerosis. *Character of operation*, relief of constriction; reduction of dark suspicious bowel (free fluid in sac contain-

ing colon bacilli); division at neck of sac and closure of peritoneal cuff; rest of wound left open. *Complications*, none. *Result*, radical cure ten days later, by Dr. Mitchell; ether anaesthesia; closure; healing *per primam*; well.

CASE XXIV.—Surgical No. 9182, July 15, 1899, Cushing. *Age*, seventy-one years, male. *Character of hernia*, large right inguinal. *Reason for selection of local anæsthetic*, age; arteriosclerosis; chronic bronchitis and emphysema. *Character of operation*, radical cure; simple closure of abdominal wall after division of cord, with transplantation of rectus muscle. *Complications and result*, slight swelling of testicle; healing *per primam*; well.

CASE XXV.—Surgical No. 9323, August 24, 1899, Cushing. *Age*, sixty years, male. *Character of hernia*, small right inguinal, with large hydrocele. *Reason for selection of local anæsthetic*, age; arteriosclerosis. *Character of operation*, radical cure; simple closure of abdominal wall after removal of hydrocele and castration. *Complications*, none. *Result*, healing *per primam*; well.

CASE XXVI.—Surgical No. —, September 16, 1899, Cushing. *Age*, forty-eight years, male. *Character of hernia*, large right inguinal. *Reason for selection of local anæsthetic*, obesity; fatty heart. *Character of operation*, radical cure; simple closure after division of cord; difficult operation from fat tissue. *Complications*, none. *Result*, healing by primary union; superficial fat necrosis threatened; wound did not open, though line of incision discolored; well.

CASE XXVII.—Surgical No. 9447, September 26, 1899, Cushing. *Age*, fifty-three years, male. *Character of hernia*, very large right inguinal. *Reason for selection of local anæsthetic*, bronchitis and emphysema; arteriosclerosis. *Character of operation*, radical cure; closure with transplantation of rectus muscle after division of cord. *Complications*, none. *Result*, healing *per primam*; well.

CASE XXVIII.—Surgical No. —, September 30, 1899, Cushing. *Age*, thirty-three years, female. *Character of hernia*, strangulated right femoral, two days; bowel viable. *Reason for selection of local anæsthetic*, prostration. *Character of operation*, simple reduction of strangulated gut; no attempt at closure; gauze pack. *Complications*, none. *Result*, healing by granulation; well.

CASE XXIX.—Surgical No. 9531, October 30, 1899, Mitchell. *Age*, seventy-five years, male. *Character of hernia*, large right inguinal with hydrocele; strangulated six hours; bowel viable. *Reason for selection of local anæsthetic*, age and strangulation. *Character of operation*, radical cure, with castration. *Complications*, none. *Result*, healing *per primam*; well.

CASE XXX.—Surgical No. 9523, October 27, 1899, Mitchell. *Age*, seventeen years, male. *Character of hernia*, congenital right inguinal, with undescended testicle; strangulated twelve hours; bowel viable. *Reason for selection of local anæsthetic*, shock, vomiting, leucocytosis of 43,000. *Character of operation*, radical cure, with transplantation of testicle. *Complications*, none. *Result*, healing *per primam*; well.

Many of the cases included in this table represent patients who would have been refused operation a few years ago. In his report on hernia, Bloodgood says (*The Johns Hopkins Hospital Reports*, Vol. vii, p. 334), relative to the days before we began the use of local anæsthesia, "In patients over fifty years of age, suffering from non-strangulated hernia, we have selected our cases because of the possible danger from the anæsthetic." Bull and Coley likewise regard sixty years of age as a contra-indication for the operation (*ANNALS OF SURGERY*, 1898, p. 598). The preceding table shows that under local anæsthesia, in the past few months, there have been fourteen patients over sixty years of age who have been operated upon not for emergency reasons, but from choice.

The citation of a few particular illustrations in greater detail will, perhaps, better elucidate the reasons for avoidance of general anæsthesia upon which we have just generalized. These cases naturally fall into two groups: (1) those in which the operation is not absolutely necessary, but done on account of the annoyance of the hernia; and (2) the cases of strangulation in which there is urgent demand for intervention. The femoral operation and that in women offers so little difficulty under a local anæsthetic that I will dwell only upon the more difficult conditions occurring in the male. Nos. XII and XIII of the table represent the type of combination of advancing age, cardiovascular changes, chronic bronchitis, and an associated annoying rupture. The case is as follows:

CASE.—Edward I., aged seventy-one years, an attorney, had suffered from a double inguinal hernia for forty years. It had always given him considerable pain, and at times had incapacitated him from the practice of his profession. He had worn a double truss for years, but it rarely controlled the ruptures for more than a few hours at a time. He suffered greatly from chronic constipation, aggravated by his inability to strain at stool, and on several occasions, during the past few years, one of the hernias had become incarcerated. The patient had for years used alcohol to excess.

Physical examination showed an old man with evidences of chronic alcoholism. His skin was loose, with panniculus abundant, and the tissues generally were very flabby. There was marked pul-

monary emphysema, sufficient to obliterate the area of cardiac dullness, and over the præcordia a harsh systolic murmur could everywhere be heard. The radial pulse was small and difficult to palpate. The abdominal walls were very lax (cf. Fig. 1), and even in recumbency the least movement caused the large bilateral inguinal hernias to protrude after they were once reduced.

A note on the local condition reads as follows: "Both hernias are complete and descend to the bottom of the scrotum, twenty centimetres below the external rings. During their protrusion the scrotum measures thirty-seven centimetres in circumference. The hernia on the right, the larger, attains the size of an infant's head. It contains bowel which is easily reducible. The external ring readily admits the tips of two fingers. The pillars are strong; they close somewhat when the patient's head is raised from the bed, and there is present a well-marked conjoined tendon.

"On the left, the sac also contains bowel, which feels doughy, and is reduced with a little more difficulty. (This proved subsequently to be a large coil of sigmoid flexure full of feces, evidently a large factor in his chronic constipation.) The external ring is large, readily admits the tips of three fingers, which pass directly through the parietes over the brim of the pelvis. The ring shows no tendency to close when the patient raises his head, and there is no evidence of a conjoined tendon. The testicle may readily be reduced, together with the sac and its contents, through this opening in the parietes."

These hernias were operated upon, one at a time, with a month's interval, as follows:

Right hernia, December 28, 1898: Radical operation under cocaine anæsthesia with preliminary one-eighth grain of morphia. The usual high incision was made through the fat abdominal wall down to the aponeurosis, which was split outward from the ring to expose the internal oblique muscle. This was flabby and pale, and was not incised as under ordinary circumstances. After cocainization of the nerves the sac was exposed, divided at its neck, and the large peritoneal opening having been closed, the fundus of the sac was stripped from the scrotum as usual. Considering the patient's age and the need of a strong parietes rather than an intact vas deferens, the cord was divided and the abdominal wall closed without Bloodgood's transplantation of the rectus, since there was a firm conjoined tendon to protect the lower angle. Although the patient had had a preliminary training in recumbency before the operation, he bore his early enforced rest in bed badly. Some evidence of hypostasis in

both lungs followed. He developed a pleuritic friction-rub, and there was for a time some evidence of loss of cardiac compensation. Doubtless a general anæsthetic would have been the extra straw in



FIG. 1.—Three weeks after operation on right side. Showing relaxed abdominal walls and descended left inguinal hernia.

producing serious pulmonary complications. The wound healed by primary union. Fig. 1 shows his condition twenty-one days after this first operation.

Left hernia, January 30, 1899: Radical operation under Schleich's infiltration anæsthesia after preliminary administration of morphia. This hernia presented much greater difficulties than the preceding

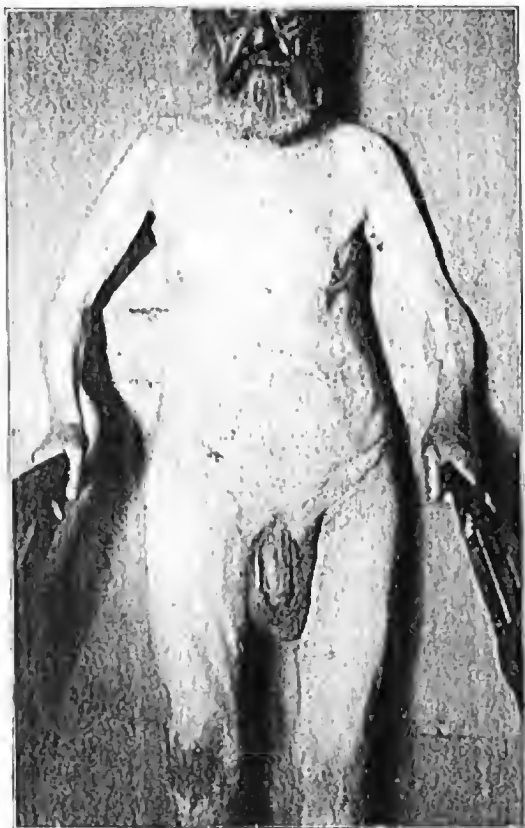


FIG. 2.—Three weeks after operation on left side.

one, but the patient stood the operation without evidence of suffering, and the convalescence was easy and uninterrupted by complications. The internal oblique muscle was incised, exposing the neck of the

sac, which was very large, its posterior wall being composed of sigmoid flexure, which had prolapsed into the scrotum. The bowel was reduced, the sac divided at its neck, the peritoneal opening closed, and the large scrotal portion of sac was then painlessly excised. The absence of conjoined tendon rendered advisable the transplantation of the rectus muscle on Bloodgood's principle to strengthen the

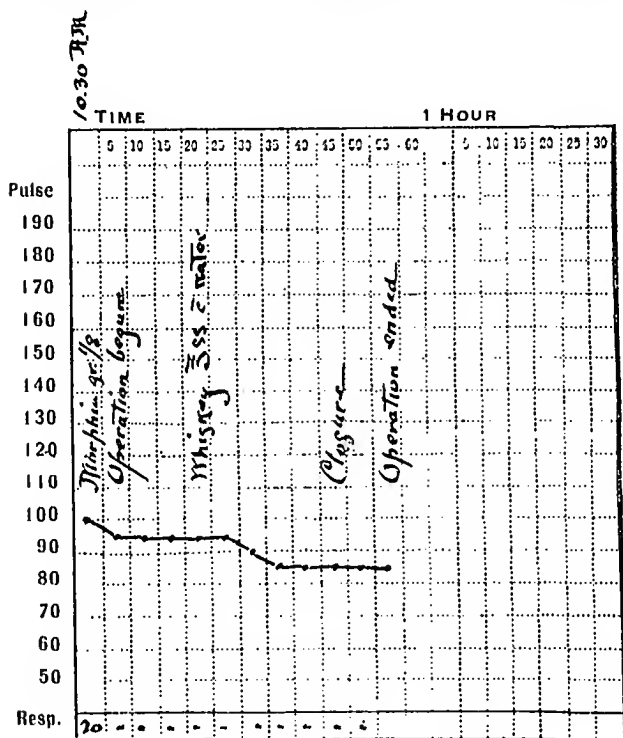


FIG. 3.—Anesthesia chart of operation in Case No. 8445.

lower angle of the wound. The parietes were closed tight after division of the spermatic cord. The wound healed by primary union. Fig. 2 shows the condition of the abdominal wall three weeks after this second operation.

The relief gained by the operation, as in all such cases in old

people, was extraordinary. The freedom from constipation, which had been resultant to the impaction of fæces in the prolapsed sigmoid and to the inefficacy of the abdominal muscles as an aid to evacua-



FIG. 4.—Case XXI. Before operation. Showing the large descended left inguinal and undescended right direct inguinal hernia.

tion, was immediate, and perhaps is one of the greatest gains in comfort following such large herniotomies in old people.

The accompanying anæsthesia chart of a plotted five-minute

pulse-rate shows how little effect the operation had upon the cardiac action. (Fig. 3.)

CASE XXI.—Large, completely descended left inguinal hernia. Large, undescended right direct inguinal hernia. (Fig. 4.) Mention is made of this case on account of the large size of the hernia, which hung half-way to the patient's knees, and measured fifty-one centimetres in circumference, and on account of the painlessness of the operation. As will be pointed out later, there is great variation in

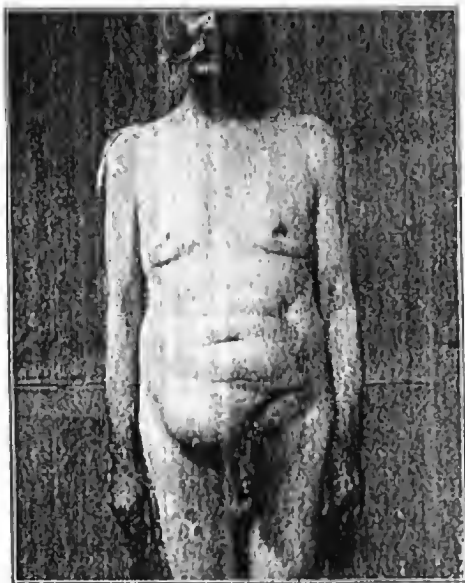


FIG. 5.—After operation on left inguinal hernia, showing area of subsequent anæsthesia.

the distribution of the nerves supplying the inguino-scrotal region, and the anastomoses may be sufficiently free to embarrass the operator even after cocaineization of the main sources of supply. In this particular case, after cocaineization of the ileo-inguinal alone, as it lay in the canal (cf. Fig. 12), no further pain was experienced by the patient, except at the lower part of the scrotum, when the testicle, which was removed, was freed from the blood-supply at its lower pole, in which

situation evidently unanæsthetized filaments of the internal pudic were encountered. Castration and transplantation of the rectus were performed and the parietes closed. In this case simple division of one nerve-trunk, therefore, anæsthetized the entire deep operative field. That this trunk was a combined one is shown in Fig. 5, which gives the area of subsequent cutaneous anæsthesia (ileo-inguinal and genital branch of the genito-crural) resultant to the operation.

The hernia on the right gave the patient no discomfort; it was controlled by a truss, and was not operated upon.

THE OPERATION IN STRANGULATION.

For cases of strangulation local anæsthesia is especially adapted. It is difficult or impossible to foretell the condition of the imprisoned bowel, and though the results in the viable cases are always successful, provided the patient escapes post-anæsthetization sequelæ (unfortunately not an infrequent complication), the mortality of those cases in which the gut is found to have lost its viability has always been high. It is in the experience of many to have seen such cases die under a general anæsthetic on the operating-table. The extreme degree of toxicité of the contents of the proximal bowel, especially when the strangulation is low, is such that patients, apparently in good condition, may succumb to an autoinfection even after relief of the strangulation. This is so well recognized that Koehler (*British Medical Journal*, October 29, 1898), Whiteford (*British Medical Journal*, April 29, 1899), and others have advocated the opening of the intestine above the constriction for the purpose of evacuating its contents, and observance of this principle might have saved Case XVII of our cocaine series. The immense amount of stinking fluid which escapes under such circumstances is familiar to all operators, and the observations of de Klecki, Sanarelli, and Dreyfuss have shown that normal intestinal bacilli may attain great virulence under such conditions. In Case XXII of my series 1200 cubic centimetres of dark, foul-smelling fluid were siphoned off with a rubber tube after the bowel was opened. The colon bacillus, cultivated from this fluid, produced an excessive amount of indol and possessed marked pathogenicity. It is in such cases as these that general narcosis,

even leaving aside the dangers of inhalation pneumonia, since constant vomiting usually is an accompaniment of these conditions, should be avoided, as it is often the additional burden which prevents recovery. This is as true of the cases in which the bowel is viable as of those with a gangrenous loop.

The patient's apparent state often belies the condition of the constricted bowel. It is not uncommon to have an individual walk into the hospital with a strangulated gut which has lost its viability. On the other hand, an imprisoned but viable loop may have caused intense shock and prostration.

It is for such reasons that exploration under regional anæsthesia is demanded, and I can only emphasize the stress laid in a former report upon this point.

Under a local anæsthetic without danger to the patient the sac may be exposed, the constriction relieved, the gut, if viable, reduced, and, depending entirely upon the patient's condition, a radical cure may be completed at the same time or at a later date, when general narcosis, if desirable, may be employed. If the gut is not viable, experience has demonstrated that the immediate establishment of an intestinal fistula is much the safest procedure, as this permits the immediate escape of the retained toxic products from the proximal bowel. This is readily accomplished under the local anæsthetic, and at a later date, when the patient has fully recovered, the intestinal suture may be performed with much less risk.

All of these points are fairly well illustrated by cases of strangulation in our series. Under some circumstances (Cases III, IV, VI, VII, IX, XVIII, and XXIX) it has been possible to complete a radical cure at the first operation. On other occasions (Cases I, XI, XX, XXII, XXIII, and XXVIII) the patient's condition would not allow of this, and a radical operation, with or without general narcosis, has been performed at a later date. In Case XXIII, a large loop, presumably of ileum, was found, deeply congested and with a dull serosa. The sac was distended with bloody fluid, which contained many bacilli on cover-slip preparation (subsequent cultivation showed bacilli coli communis). With some hesitation the

gut was returned and the peritoneum closed. The rest of the wound was left open, in anticipation of a possible infection, which, however, did not follow, and Dr. Mitchell, ten days later, performed a radical operation under ether anæsthesia. This is the first case of strangulation in this hospital, I believe, in which the bowel has proved to be viable and yet has allowed of the migration of intestinal organisms. The fluid contents of the sac from all of our cases, except the gangrenous ones, has heretofore proved to be sterile, which corresponds with the experience of German writers.

The cases with gangrenous bowel present a more difficult problem. With only two or three exceptions, at this hospital, such conditions have led to a fatal termination. On one occasion Dr. Bloodgood resected and sutured a gangrenous bowel in a young man under general narcosis, with recovery. Case XXII of the above cocaine series also recovered after a resection. The other cases have succumbed, if not directly to the anæsthetic, soon afterwards, and often from pulmonary complications. Case XX of the table shows that there is a predisposition to pulmonary disturbance, even when inhalation anæsthesia has not been employed, and the effects of ether or chloroform furnish an additional burden, which is more than can be carried. Occasions doubtless arise when an immediate anastomosis can be made, but under ordinary circumstances I believe it is preferable, as stated above, to establish an artificial anus, and allow all of the contents of the upper bowel to become rapidly evacuated. Immediate improvement follows such a measure. A secondary operation, with intestinal anastomosis, may be required at an early date, provided the fistula is a high jejunal one. If, on the other hand, it is low, the secondary suture may be indefinitely postponed. This question of high fistulae is illustrated by the following case:

CASE XXII.—The patient, Mrs. H., aged fifty-five years, was seen August 3, 1899, suffering from a strangulated right inguinal hernia of three days' duration. Her condition was poor, vomiting was stercoraceous and frequent, and an immediate operation under local anæsthesia was performed. A gangrenous loop of bowel was found, which was excised, and an immediate fistula established. It

was feared at the time that the fistula might be high, as there was but little abdominal distention despite the duration of the obstruction. From the upper bowel a large amount (1200 cubic centimetres) of foul-smelling, dark fluid, of the same character as the vomitus, was siphoned off through a rubber tube, and the bowel thoroughly irrigated with salt solution. Relief was immediate and vomiting ceased. Unfortunately the seat of strangulation was high, possibly mid-jejunal, and it was found that all ingesta would appear in a very short time at the established fistula, having undergone but little if any absorption. In a few days the skin became deeply eroded and exceedingly sensitive over the whole right side. Feeding by the distal loop, from some mechanical twist of the bowel, was found to be impossible, and the rectum soon rebelled against nutritive enemata. Such a combination of circumstances was most serious, and the patient emaciated rapidly. With some difficulty she was persuaded to enter the hospital, where she was put in a constant bath, and under water the dermatitis rapidly cleared up. Four days later she was operated upon; a lateral anastomosis and suture, without mechanical aid, was made, the fistulous end of the bowel removed, and the wound closed. She made an uneventful recovery.

An important step preliminary to the operation was taken; a procedure, the value of which has been emphasized heretofore by the writer. For two days before the operation every precaution was taken to prevent the entrance of micro-organisms into the stomach; the mouth was cleansed and all ingesta sterilized. The accompanying figures (Fig. 6, *a*, *b*, and *c*) show graphically the result,—viz., three Petri dishes, which were, upon different occasions, inoculated with one platinum loop full of the contents of the discharging fistula. *A* represents the inoculation at entrance; *b*, on the second day after sterile diet; and *c* was made from the contents of the bowel at the time of suture. The bacteriological questions involved will be discussed in another paper, but any comparison between the probabilities of a successful suture at the time of the first inoculation, when the lumen was teeming with micro-organisms, and at the last, with a practically sterile bowel, is not to be made.

Needless to say, such a successful result will not always follow, and the diminished resistance of the patient, who has been prostrated by the shock and subsequent toxæmia of

strangulation, is often provocative of pulmonary complications, which inhalation narcosis would insure, and operative relief,



FIG. 6 (a).—August 19, 1899. Culture from discharging fistula. No dietary precautions.



FIG. 6 (b).—August 21, 1899. After twelve hours of sterile diet.

even under local anæsthesia, comes too late to ward off. For example, in Case_XX, a man, aged seventy-six years, presented

a gangrenous strangulation of four days' duration. On March 21, 1899, a fistula was established under cocaine anæsthesia, through misguided judgment, without complete excision of all of the gangrenous loop of bowel, though it was left out of the abdomen. The patient was *in extremis* at the time of operation, with evidences of hypostasis. By the second day the proximal bowel had emptied itself, and he had improved sufficiently to make me think it advisable to remove the remaining portions of the necrotic intestine. This was done under local anæsthesia, and gave so little discomfort that the opening into the abdomen



FIG. 6 (c).—At operation and suture, August 24, 1899. After four days of sterile diet and an eight hours' fast.

was enlarged, the ends of the bowel lifted out, and sutured by an end-to-end anastomosis over a Halsted bag. The suture was dropped and the peritoneum closed. The patient died on the sixth day. At the autopsy Dr. MacCallum found a condition of extensive broncho-pneumonia. Cultures from the peritoneal cavity were sterile. The suture was intact.

It is in border-line cases of this sort that local anæsthesia gives the best chance of recovery. In just such cases as the one related above do we often meet with death under, or rapidly following, the general anæsthetic.

OBSERVATIONS FROM COCAINE OPERATIONS UPON THE NEURAL ANATOMY OF THE HERNIAL REGION.

The application of an anatomical familiarity with the peripheral distribution of the spinal nerves, which, under the influence of general anæsthetics has fallen into abeyance, becomes once more of interest and importance to the surgeon in extensive operations under local anæsthesia. Furthermore, no condition has ever afforded similar opportunities for the accurate investigation of the sensory distribution of these nerves, since methods of dissection are necessarily gross, and physiological experiments upon animals naturally present variations from the human type.

The principles of cocainization of main trunks of nerves, introduced by Corning in 1885, have since been utilized in operations on the extremities for minor and even major amputations, for the anæsthetization of areas preliminary to the removal of skin-grafts¹ and like procedures, but I am unaware that heretofore similar methods have been made use of in operations on the trunk. To insure success in any major operation attempted under local anæsthesia, an accurate knowledge of the course and situation of the nerves likely to be encountered is most essential, since the accidental division of an unexpected sensory nerve-trunk is often sufficient to overcome whatever preliminary inhibition to pain the patient may have had, and thus to make recourse to complete narcosis necessary in cases where it should, perhaps, be specially avoided. In my earlier hernia operations I frequently inflicted pain where now none is occasioned, owing to greater familiarity with the course and distribution of the nerves concerned.

In the accompanying sketch (Fig. 7) an attempt has been made to show diagrammatically the usual cutaneous distribution of the inguino-scrotal nerves as well as the deeper situation of the main trunks. Through the kindness of Dr. Bardeen I have been able to compare with my results a great number of sketches made in the anatomical department for an unpublished

¹ Cocainization of the anterior crural, below Poupart's, for the removal of large Thiersch grafts from the front of the thigh, was introduced at this hospital by Dr. Young.

report on the peripheral nervous system, and though there is considerable variation in the situation and anastomoses of the particular nerves of this region, as may be seen by consulting

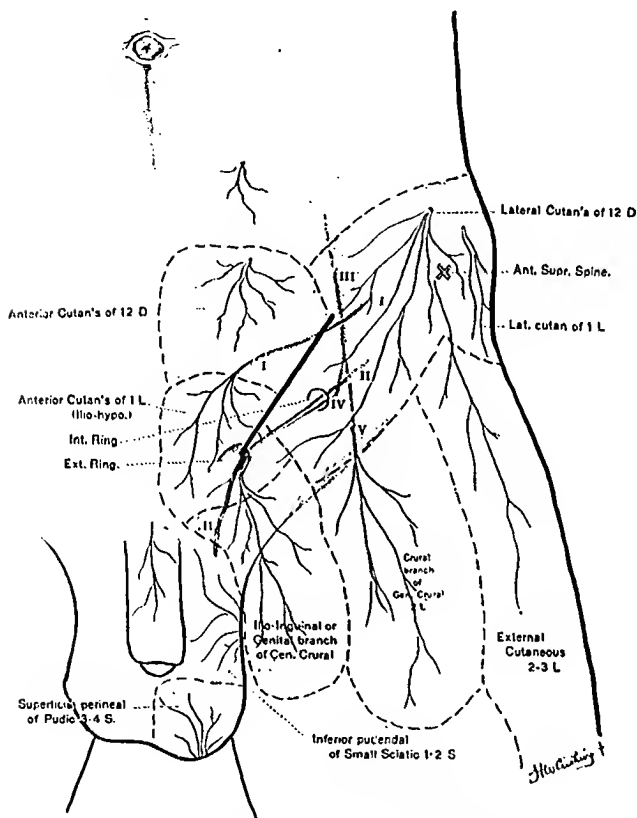


FIG. 7.—Showing inguino-scrotal nerves, their peripheral distribution, and relation of the main trunks to the hernia incision, I, Ilio-hypogastric; II, Ilio-inguinal; III, Genito-crural; IV, Genital branch; V, Crural branch.

Griffin's article (*Journal of Anatomy and Physiology*, 1891), we have taken what may represent the average.

Superficial Nerves encountered by the Incision.—The skin

incision, as ordinarily made, passes in a line which separates the ventral and lateral cutaneous branches of the twelfth dorsal and first lumbar nerves. The lower angle of the incision, however, quite uniformly overlaps the anterior branches of the first lumbar (ilio-hypogastric) nerve, as they sweep downward and outward from their point of emergence through the aponeurosis, about five centimetres above the external ring. The upper angle of the incision, depending somewhat on its distance from the median line, and also upon the variable and

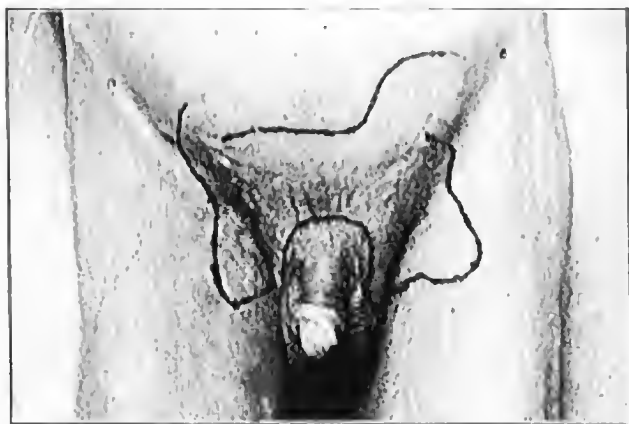


FIG. 8.—Areas of anæsthesia after double cocaine herniotomy. Anæsthesia lies to the inner side of left incision, which was made nearer Poupart's ligament and has divided lateral cutaneous branches of twelfth dorsal. It lies to the outer side of the right incision made farther from Poupart's and dividing fibres from the anterior division of twelfth dorsal.

complementary length of filaments of the ventral and lateral branches of the twelfth thoracic, may divide fibres from one or the other of these sources, and thus lead to a subsequent area of anæsthesia to the inner or outer side of this upper angle of the incision. This is well illustrated by the accompanying photograph (Fig. 8) of a double herniotomy, in which the incisions were made at different distances from the median line. This bordering anæsthesia, on one side or other of the skin

incision, may occasionally represent the entire area of post-operative cutaneous anæsthesia, even when the ilio-inguinal and genital branch of the genito-crural have been divided or cocaineized, as is shown in photograph (Fig. 9). Presumably in such instances the crural branch of the genito-crural supplies the area on the inner side of the thigh, usually accredited to the former two nerves. Such an arrangement occurs occasionally in Dr. Bardeen's diagrams.

Deeper Nerves met in the Operation.—The ilio-inguinal



FIG. 9.—Showing small post-operative area of anæsthesia to the inner side of the incision, consequent to the division of lateral cutaneous branches of the twelfth dorsal. In this case the ilio-inguinal and genital branch of the genito-crural had been divided with loss of cremasteric reflex, but without producing any cutaneous anæsthesia.

nerve emerges from the external ring, and near by, or also through the ring, the genital branch of the genito-crural appears. In the canal they usually are found anastomosed as one trunk, the early cocaineization of which at the deeper part of the canal, after splitting the aponeurosis beyond the internal ring, is perhaps the most important step of the operation. As has been stated above, this may result in no additional cutaneous anæsthesia. The usual anæsthetic sequel, however, is represented by a complete loss of sensation of the entire scrotal

contents, cord, hernial sac, and testicle, with the possible exception of its lower vascular supply (superficial perineal), and by a cutaneous area of anæsthesia which occupies the inner side of Scarpa's triangle, spreading over the adductor tendons. Division of the nerve is unassociated with any surface anæsthesia of the scrotum whatever (cf. Fig. 10). It is ordinarily stated, to the contrary, that these nerves are a source of cutaneous supply to the scrotum; for instance, Professor Thane says



FIG. 10.—Area of anæsthesia of ilio-hypogastric, ilio-inguinal, and genital branch of genito-crural in a unilateral cocaine case, following operation. This began to fade by the twenty-first day, with return of cremasteric reflex. This represents the most complete type of anæsthesia in unilateral cases, and is the same even after division of the cord and castration, and consequent section of all possible cutaneous filaments of the genital branch of the genito-crural and the ilio-inguinal.

(Quain's "Anatomy," Vol. iii, Pt. II, p. 341, 1895), "The root of the penis, on its dorsal aspect, and a part of the scrotum anteriorly are supplied by the ilio-inguinal and genito-crural nerves." It was of extreme interest, consequently, to find that the ilio-inguinal, supplying most of the *contents* of the scrotum, was not represented by any *cutaneous* supply to the same. The inferior pudendal of the small sciatic and superficial perineal of the internal pudic, therefore, supply in most cases, at all events, its entire cutaneous surface. It is possible that, on the principle

of Sherrington's observation concerning the overlapping of sensory areas, we might account for the failure of anæsthesia after division of the single nerve to appear over its whole territory

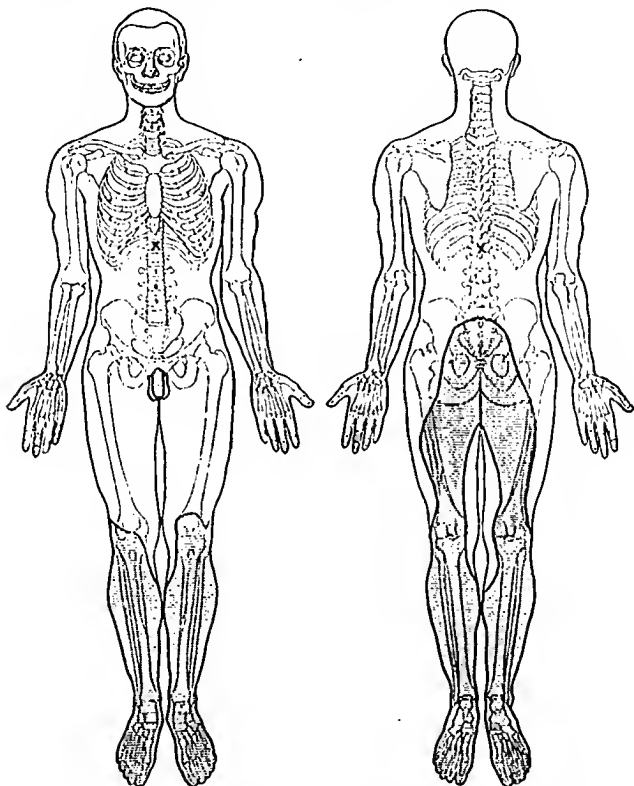


FIG. 11.—Areas of cutaneous anæsthesia resultant to a compression fracture of the twelfth dorsal vertebra, producing a total transverse lesion at the fifth lumbar segment. Scrotal and penile anæsthesia is complete, though the lesion lies below the first lumbar (ilio-inguinal) segmental level.

of supply, but as will be seen by comparing segmental spinal lesions such an explanation will not hold, and probably the whole scrotal cutaneous supply is from the sacral and not the lumbar plexus. A case of fracture-dislocation of the spine at

the twelfth dorsal vertebra, with transverse lesion of the cord, entered the hospital at the time these observations were being made, and offered confirmatory evidence of what has just been stated. The anæsthetic areas resultant to this injury, and which are shown in the accompanying diagrams plotted by Dr. Yates (Fig. 11), offered an interesting negative of the anæsthesia following the hernia cases. Though the entire penis and scrotum in this case were devoid of sensation, the transverse lesion of the cord was situated at the fifth lumbar segment,—that is, between the level of origin of the ilio-inguinal (first lumbar) and that of the small sciatic and internal pudic (second and third sacral) nerves. If the ilio-inguinal normally overlapped the latter nerves, the root of the penis and upper part of the scrotum would naturally have retained sensation. A similar condition is shown in one of Kocher's diagrams of a case of fracture-dislocation at this level.

Furthermore, in this spinal case, as would be expected, the cremasteric reflex was retained, whereas we have observed that after division of the ilio-inguinal and genito-crural nerves, this reflex is, temporarily, at all events, lost on the side of division.¹ On the other hand, the vermicular movements of the dartos, supplied together with the skin by the sacral nerves, are preserved after division of the ilio-inguinal, but were lost in the spinal case together with the cutaneous anæsthesia.

The ilio-hypogastric, as will be seen in the diagram (Fig. 7), may be twice encountered in the operation; its superficial supply by the skin incision, as has been described, and its deeper trunk, as it lies upon the muscle-fibres of the internal oblique at a varying distance from the lower edge of muscle, by the incision which divides this muscle (Fig. 12). Cocainization of the edge of this muscle, consequently, before its division is very necessary, especially since, in addition to this main trunk, which may usually be easily recognized after exposure of the internal oblique, there are, contrary to Griffin's observations, offshoots to the muscle itself from this nerve, given off dorsad to the portion exposed by the incision, as well as fibres from the genito-crural (Thane), which also supply this lower border of

¹ It is important, therefore, to guard against division of these nerves in varicocele operations in which it is desirable to preserve cremasteric tone.

the internal oblique. The area of cutaneous anæsthesia, which follows anæsthetization or division of the main exposed trunk, surrounds the lower angle of the incision, and extends from a level about seven centimetres above the root of the penis to within one or two centimetres of that organ. No anæsthetic area has ever been found corresponding to Macalister's described branches reaching up towards the umbilicus. In unilateral cases this ilio-hypogastric anæsthesia does not extend to the median line, owing to the overlapping of fibres from the opposite side, so that in bilateral cases alone, such as are illustrated by Fig. 8, can its limits be definitely made out.

THE ANÆSTHETIC, AND APPLICATION OF ANATOMICAL OBSERVATIONS TO THE OPERATION.

It is not within the scope of this paper to discuss the relative merits of various local anæsthetics; suffice to say that we have found the combination advocated by Schleich ("Schmerzlose Operationen," 1899) to be as efficacious as any with which we have experimented. His solution No. 2, containing the following ingredients,

| | |
|---------------------|--------|
| Cocainæ mur., . . . | 0.1 |
| Morphinæ mur., . . | 0.02 |
| Sodii chlor., . . . | 0.2 |
| Aqua destillata, ad | 100.00 |

has best served our purpose, and has been without the objections usually accredited to cocaine solutions,—viz., toxicity and dissolution when sterilized. Solutions in strength of 1 to 20,000 Schleich claims to be efficient for infiltration, and capable of producing anæsthesia which is free from the prodromal hyperæsthesia, the "anæsthesia dolorosa," which accompany water and saline infiltrations. Amounts of the 1 to 1000 solution, however, greatly in excess of what is needed for the longest operation, have failed to give toxic symptoms, and, contrary to the experience of many, we have found that one or two sterilizations fail to diminish its efficiency. Experience with eucaine β , which Braun (*Archiv für klinische Chirurgie*, 1898) and Hentze (*Archiv für pathologische Anatomie und Physiologie*, 1898) have so strongly advocated, has failed to demonstrate any

superiority over the 0.1 per cent. cocaine solution of Schleich. In fact, we have been impressed by the fleeting nature of the anæsthesia and by its tardy appearance.

On several occasions long skin incisions have been made through a linear area of anæsthesia, produced half with sterilized Schleich's solution and half with the eucaine β combination, which Braun advocates. If the operation is prolonged over an hour, pain is occasioned on placing the subcuticular suture of closure in the eucaine area, while none appears in that which had been infiltrated with cocaine. The fact that its toxicity is five times greater than eucaine does not argue in its disfavor, provided one uses solution weak enough to avoid toxic effects. For anæsthetization of the individual nerve-trunks I have used a $\frac{1}{2}$ to 1 per cent. sterilized solution of eucaine β or cocaine which is injected directly into the nerve.

Steps of the Operation.—Individuals advanced in years are usually kept in bed for a day or two preliminary to the operation, to give an indication of their ability to endure recumbency and for the purpose of training them to void their urine in this position. Evacuation of the bladder is usually accomplished by the aid of an enema if any postural difficulty is experienced; and it is a matter of satisfaction that but one of the cases reported required post-operative catheterization (Case XVI), an old man, sixty-eight years of age, who had symptoms of prostatic hypertrophy.

It has been the custom to administer hypodermically a tenth or an eighth of a grain of morphine, three-quarters of an hour before, and to repeat this shortly before the operation. Ceci has emphasized the efficiency of this morphia-cocaine combination, and I have found it most satisfactory. The drug must be used with caution, however, since occasionally even small doses of morphine in old people may confine the bowels and lead to distention, which may be troublesome, as Case XV of our series illustrates. Similarly, in old people with tardy bladders, it may inhibit the proper evacuation of the urine, though we have never had the misfortune to observe this.

Patients past middle age also are usually shaved and prepared on the operating-table, to avoid any exposure incidental to an open ward preparation. The skin in the line of proposed

incision is infiltrated with Schleich's cocaine solution, and the incision may be immediately made through the linear wheal thus produced. It is common experience to find the infiltrated tissues more vascular than usual, and it is important that all bleeding points be immediately clamped, since a dry and unstained field is essential to the success of the dissection. It is unnecessary and useless to attempt to anæsthetize the panniculus. As Schleich has shown, only tissues which can be "œdematized" are fitted for the infiltration method, and in the panniculus, at the upper angle, practically no nerves are encountered. If, however, throughout its whole length, this incision is carried down to the aponeurosis, unanæsthetized fibres of the ilio-hypogastric will be encountered in the superficial fat at the lower angle, together with one or two large veins, division of which is painful, so that anæsthetization of the panniculus layer is here necessary, or else, as has been done on several occasions, the incision only at the upper angle may be carried down to the aponeurosis, which is then opened in line of fibres from the external ring and the ilio-hypogastric and inguinal nerves immediately cocainized with a 1 per cent. solution as they lie under it. After this procedure the lower angle of the incision may be painlessly carried down to the external ring, and the remaining intercolumnar fibres of the aponeurotic incision divided. Reflection of the pillars of the ring gives the view shown in the accompanying sketch (Fig. 12). In the Halsted operation at this stage the internal oblique fibres are divided, preliminary cocainization of the edge of muscle being necessary for the reasons given above. There is, under ordinary circumstances, no further need of the anæsthetic, as we are working in an area freed from all sensation. The combined ilio-inguinal and genital branch, which has been cocainized at the outer limit of its exposure, is now reflected to one side or the other, care being taken not to divide it, since this leads apparently to a more or less permanent paralysis of the cremaster, which is to be avoided. I believe the accidental division of this nerve leads to the great relaxation of the scrotum so often seen after hernia and varicocele operations. In the latter operation, especially, it would be detrimental to the best interests of a successful result to interfere with the cremasteric

function in any way. The remainder of the operation, the exposure of the sac and cord after a longitudinal division of the infundibuliform fascia, the amputation of the sac at its neck, and closure of the peritoneal opening, the excision of the fundus of the sac, division of the cord and castration, if

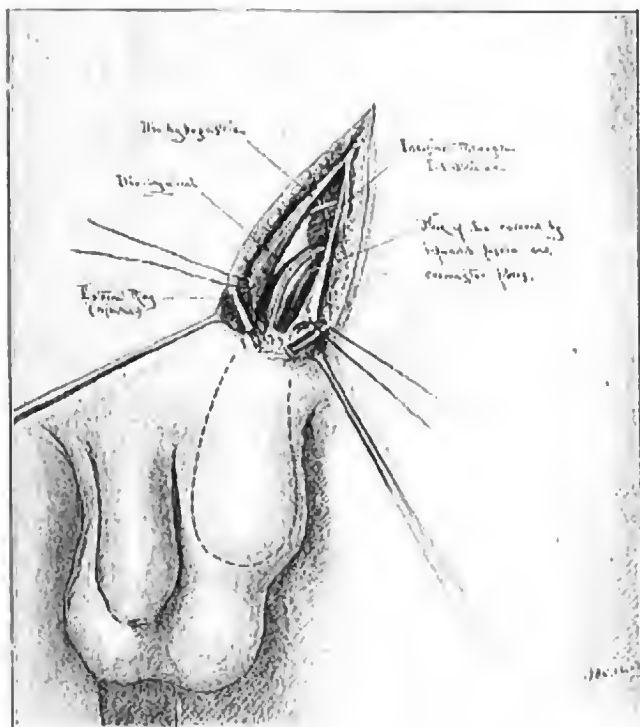


FIG. 12.—Sketch showing usual situation of nerves as exposed after reflection of the divided aponeurosis.

deemed advisable, may now be done practically without pain. Occasionally, however, some stray fibres of the genito-crural may be encountered about the neck of the sac, and also during castration I have found that ligation of the veins at the lower pole of the testicle may be painful, though division of the cord

above is not. Possibly the superficial perineal branches which have been unanæsthetized furnish nerves to this lower blood-supply.

The closure of the parietes by any of the more commonly employed methods may now be painlessly accomplished. Not infrequently in these cases, in old people with large hernias of long standing, the two rings have become concentric, and the falciform expansion of the conjoined tendon is no longer present. It is in such cases that Bloodgood has advocated transplantation of the rectus fibres after opening of the sheath and exposure of this muscle, so that a muscle-lined wound may be formed throughout the whole length of the inguinal region. No additional cocainization is necessary for this step. Tightening the deep sutures in closing the wound causes some discomfort, which the patient usually describes as an uncomfortable sensation of "pressure." The subcuticular silver suture, used in closing the skin, does not pass beyond the limits of the original area of cutaneous infiltration, and consequently it may be placed without pain. It occasionally happens during the operation, whether from slight ability on the patient's part to endure discomfort or from the accidental division of some sensory fibres, that what inhibition towards pain he may have at first possessed becomes exhausted, and recourse must be had to a general anæsthetic. Under these circumstances we have found that a few inhalations of chloroform—not enough, however, to make the patient lose consciousness—are sufficient to tide him over the most difficult parts of the operation. It is remarkable, under such circumstances, how small an amount of the general anæsthetic is required to benumb sensation. We may justly speak, therefore, of the method of anæsthesia which is employed as a morphia-cocaine-chloroform combination, the first and last drugs being merely adjuvants of the local anæsthetic, which in most cases suffices alone.

An assistant in these cases who takes the place of the anæsthetist occupies by no means an unimportant position. The usual record of pulse and respiration is kept, and by occupying his attention and by timely encouragement the patient may be tided over the more trying periods of his operative

ordeal; duties which otherwise devolving upon the operator may be distracting. Lilienthal (ANNALS OF SURGERY, 1898, p. 58) speaks of this position as that of a "moral anæsthetist."

Patients have never complained of post-coeainization pain in the region of the incision, and healing seems to have been absolutely unaffected by the local infiltration. In none of these cases has there been other than primary union. It is very unusual for the large, starched, or plaster dressings, immobilizing thigh and pelvis, to be cut down before the tenth or twelfth day, when the suture is removed.

Advantages of the Local Anæsthetic.—There is an avoidance of unpleasant or dangerous post-etherization sequelæ. There is no vomiting or retching to put strain upon the recent sutures. Urinary disturbances are much less apt to occur, and catheterization is rarely necessary. The diet continues as before the operation. There is no backache, since there is no narcosis to induce relaxation of spinal muscles. The dressings may be applied originally to suit the comfort of the patient, which is of especial importance in old people, and there is no subsequent disarrangement of them. Above all is the advantage gained in being able to operate with comparative safety in patients who would incur immediate risk in submitting to general anæsthesia.

Disadvantages.—These seem trivial in comparison. More time is consumed in the operation, and there is necessarily some distraction to the surgeon. The operation is doubtless more difficult and some pain is inflicted. The degree of this depends entirely, however, upon the surgeon's familiarity with the steps of the operation and his knowledge of the anatomical distribution of the sensory nerves of the region concerned. On many occasions no actual pain whatever need be experienced, and should there be some, it is small in comparison with the discomforts of an ether convalescence, and the greater difficulties which confront the surgeon at the operating-table are more than compensated for by his subsequent freedom from the anxiety which, in this particular class of cases, attends the administration of, and convalescence from, general anæsthesia.